

Claims

- [c1] A process for treating water containing dissolved salts selected from the group consisting of calcium sulfate, calcium chloride, magnesium sulfate, magnesium chloride, sodium carbonate, sodium chloride, sodium sulfate, calcium carbonate, and mixtures thereof comprising
- (A) adding to said water about 0.1 to about 60 g/L of a compound selected from the group consisting of sodium hydroxide, sodium carbonate, potassium hydroxide, potassium carbonate, calcium hydroxide, calcium carbonate, aluminum hydroxide, aluminum sulfate, aluminum potassium sulfate, and mixtures thereof, whereby a precipitate forms in said water;
 - (B) separating said precipitate from said water; and
 - (C) desalinating said water.
- [c2] A process according to Claim 1 wherein prior to step (A) said water is filtered.
- [c3] A process according to Claim 1 wherein said water is desalinated using reverse osmosis.
- [c4] A process according to Claim 1 wherein said water is desalinated using flash evaporation.

- [c5] A process according to Claim 1 wherein said solid precipitate is separated by filtration.
- [c6] A process according to Claim 1 wherein desalinating said water produces a first stream that has a lower concentration of dissolved solids and a second stream that has a higher concentration of dissolved solids, and
- (A) a mixture is formed of said second stream and said water containing dissolved salts;
 - (B) if the concentration of said compound in said mixture is less than about 0.1 wt%, a sufficient amount of said compound is added to said mixture to bring its concentration within a range of about 0.1 to about 60 wt%; and
 - (C) said mixture is recycled to step (B).
- [c7] A process according to Claim 1 wherein acid is added to said water after step (B) to lower the pH of said water to between about 6.5 and about 8.5.
- [c8] A process according to Claim 7 wherein the pH of said water is adjusted before step (C).
- [c9] A process according to Claim 1 wherein said compound is selected from the group consisting of calcium oxide, calcium hydroxide, sodium hydroxide, sodium carbonate, and mixtures thereof.

- [c10] A process according to Claim 1 wherein the amount of said compound is about 0.2 to about 40 g/L.
- [c11] A process according to Claim 1 wherein said desalinating is performed at a temperature in excess of 70°C.
- [c12] A process according to Claim 1 wherein said water is brackish water.
- [c13] A process according to Claim 1 wherein said water is sea water.
- [c14] A process according to Claim 13 wherein said compounds are added in two steps, a first step in which about 0.04 to about 40 g/L of calcium hydroxide, calcium oxide, or a mixture thereof is added, whereby a first precipitate is formed and is separated from the water, and a second step in which about 0.1 to about 60 g/L of sodium carbonate and about 0.04 to about 40 g/L of sodium hydroxide, or a mixture thereof is added, whereby a second precipitate is formed and is separated from the water.
- [c15] A process for treating sea water to reduce the concentration of salts therein comprising
 - (A) adding to said water about 0.04 to about 40 g/L of a compound selected from the group consisting of

calcium hydroxide, calcium oxide, and mixtures thereof, whereby a first precipitate is formed;
(B) separating said first precipitate from said water;
(C) adding to said water about 0.01 to about 60 g/L sodium carbonate and about 0.04 to about 40 g/L sodium hydroxide, whereby a second precipitate is formed;
(D) separating said second precipitate from said water; and
(E) desalinating said water using reverse osmosis.

[c16] A process according to Claim 15 wherein, in step (A), calcium oxide is added.

[c17] A process according to Claim 16 wherein the amount of said calcium oxide added is about 0.07 to about 30 g/L, the amount of said sodium carbonate added is about 0.12 to about 50 g/L, and the amount of said sodium hydroxide added is about 0.9 to about 34 g/L.

[c18] A process for treating sea water to reduce the concentration of salts therein comprising

(A) adding to said water about 0.4 to about 40 g/L of a compound selected from the group consisting of calcium hydroxide, calcium oxide, and mixtures thereof, whereby a first precipitate is formed;
(B) separating said first precipitate from said water;

(C) adding to said water about 0.1 to about 60 g/L sodium carbonate and about 0.04 to about 40 g/L sodium hydroxide , whereby a second precipitate is formed;

(D) separating said second precipitate from said water; and

(E) desalinating said water using flash evaporation.

[c19] A process according to Claim 18 wherein, in step (A), calcium oxide is added.

[c20] A process according to Claim 19 wherein the amount of said calcium oxide added is about 0.07 to about 30 g/L, the amount of said sodium carbonate added is about 0.12 to about 50 g/L, and the amount of said sodium hydroxide added is about 0.9 to about 34 g/L.